

SOME EARTHWORMS FROM KASHMIR, BOMBAY, AND  
OTHER PARTS OF INDIA.

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The present paper contains an account of some Oligochaeta recently received for identification from the Indian Museum. In part these have been collected by the officers of the Zoological Survey, and in part sent to the Museum by other naturalists,—Prof. J. J. Asana of Ahmedabad and Prof. J. P. Mullan of Bombay. The collection of the last-named contained some interesting specimens.

## THE EARTHWORMS OF KASHMIR.

Our knowledge of the worms of Kashmir has hitherto been meagre in the extreme. In the Report on the Natural History Results of the Pamir Boundary Commission, published in 1898 (1) Alcock states: "Three species of earthworms were obtained, one in the Kishenganga Valley at 8000 ft., one in the Gilgit River Valley at over 7000 ft., and one in the Yasin Valley at 8000 ft. Specimens of all of these were sent to Mr. F. E. Beddard, F.R.S., who writes as follows concerning them: 'They are entirely European, i.e. Palaearctic species; they belong, in fact, to the usual British forms. This is of interest, as being an approximation to discovering the limits of the Oriental region for worms.'"

Michaelsen in 1909 (3) identified three species (*Eisenia rosea* (Sav.), *Helodrilus* (*Allolobophora*) *caliginosus* subsp. *trapezoides* (Ant. Dug.), and *Helodrilus* (*Bimastus*) *parvus* (Eisen) in collections received from the Indian Museum; and I had a *Limnodrilus*, species unrecognizable, sent to me from one of the high lakes (9). Thus the only identified species of Oligochaeta from this region are the three recorded by Michaelsen.

This is perhaps surprising, seeing that Kashmir is a favourite summer resort, and is visited annually by large numbers of travellers from all parts of India, and indeed from other parts of the world also. There are possibly two reasons for the paucity of the collections. One is that Kashmir is a holiday country, and zoologists who visit it are doubtless concerned rather in providing for themselves a change of interests than in pursuing their usual occupation;—at least this has been the case with myself. The other is that it has been recognized that Kashmir belongs to the Palaearctic region, and not to the Oriental, which is of greater interest to Indian naturalists.

The present small collection contains only three identifiable species, of which two have been previously recorded, while one is new. These all belong to the Lumbricinae, a Palaearctic group.

## THE RANGE OF THE LUMBRICINAE.

The Lumbricinae are a recently evolved and dominant group of earthworms, which possesses great powers of adaptation to new surroundings, and of which numerous species have been carried by man and have established themselves all over the world.

The occurrence of these peregrine species of Lumbricinae gives no clue, therefore, to the zoogeographical affinities of the region where they are found; and since Beddard's and Michaelsen's records are entirely of these "world-wanderers," it would have been permissible to regard Kashmir as possessing no proper earthworm fauna of its own, and therefore as not to be included in the territory of any particular family or group of Oligochaeta.

Some little time ago, however, I described a new species of Lumbricine from Murree in the Himalayas (10), a few miles only from the southern border of Kashmir. In addition, one of the

species here recorded from Kashmir appears to be new, and therefore possibly endemic. These justify the inclusion of this region, at least provisionally, in the territory of the Lumbricinae.

Simla, the summer capital of India, and the surrounding area in the W. Himalayas, swarm, as might be expected, with peregrine Lumbricines, from which no zoogeographical conclusions can be drawn. But here too a new and possibly endemic Lumbricine is now found to occur (*Helodrilus (Dendrobaena) kempi*, v. *infra*); the W. Himalayas may thus probably be added to the proper territory of the Lumbricinae. The extreme outpost of the sub-family appears to be Calcutta, whence *Helodrilus (Bimastus) indicus* was described some years ago by Michaelsen (3). These four species are the only endemic Lumbricinae so far known in India.

#### THE POLYPHYLETIC ORIGIN OF THE GENUS *MEGASCOLEX*.

That the genus *Megascolex* is polyphyletic, i.e. that different species of the genus have arisen in different places, at different times, and from different ancestors, is already recognized. Michaelsen (5) has pointed out the close relation of certain S. Indian species of *Megascolex* to certain S. Indian species of *Notoscolex* (the group of *Megascolex travancorensis* to that of *Notoscolex ponnudianus*), and argues that these species of *Megascolex* have in all probability arisen from the local representatives of *Notoscolex*. There is also a similar correspondence between species of *Notoscolex* and species of *Megascolex* in another restricted area, the N. Island of New Zealand; here, too, the inference is that the latter have arisen from the former. I have shown (II) that a worm which is by definition a *Megascolex* has descended from some species of *Perionyx*, in a region more than a thousand miles away from the proper Indian *Megascolex* territory; and have in the same paper given some reason for thinking that certain species of *Megascolex* may be descended from still another genus *Spenceriella*.

Perhaps the clearest case of an independent origin of a species of *Megascolex*, however, is that of *Megascolex horai*, described below. The worm has certain remarkable peculiarities; it is unique in the genus in having the male pores on segment xvii, one segment in front of the normal position for the genus; and both male and female organs are found, on dissection, to be shifted one segment forwards. There are also well marked and stalked calciferous glands in segments x, xi and xii; such stalked calciferous glands scarcely occur elsewhere amongst the Indian species of *Megascolex*.

Now a small group of species of *Notoscolex* has exactly these same characters; and here too the species (*Notoscolex oneilli*, *stewarti*, and *striatus*) are peculiar in these respects in their genus. The species of *Notoscolex* were found in the Abor country in the Assamese Himalayas; *Megascolex horai* was taken at Cherrapunji, also in Assam (though not in the Himalayas), more than a thousand

miles from the proper Indian *Megascolex* region. There can be no doubt that while the majority of species of *Megascolex* have arisen from *Notoscolex* elsewhere, this species has had an independent origin from a local species of *Notoscolex* in Assam.<sup>1</sup>

#### SOME OTHER SPECIES OF INTEREST.

A new *Drawida* and a new *Perionyx* are also to be recorded from Assam, and a new *Eudichogaster* from Bombay.

It has been interesting to rediscover *Eutyphoeus orientalis* (Bedd.) with its peculiar penial setae, and *Octochaetus beatrix* Bedd., in which I have found small penial setae, previously overlooked.

Both the new species of Lumbricinae illustrate the fact, brought out by Michaelsen (4), that the subgenera of *Helodrilus* may run into each other, and have no sharp limits. Thus one of the species, which I assign to the subgenus *Allolobophora* agrees with *Bimastus* in having no spermathecae; while the other, which I place in *Dendrobaena*, agrees with *Allolobophora* in the characters of the seminal vesicles.

#### Family MONILIGASTRIDAE.

##### Genus *Drawida* Mich.

##### *Drawida nepalensis* Mich.

Dehra Dun, compound of the Forest Research Institute (serial No. 111 of 27.viii.1921).

Dorsal pores are usually absent in the genus *Drawida*, but I have previously noted (10) that in this species vestiges are present, in the form of gaps in the muscular layers of the body-wall. These vestiges were very obvious in the present specimens, though there were no actual perforations. They occurred from furrow 4/5 onwards.

##### *Drawida rosea*, sp. nov.

Cherrapunji, Assam; under stones and in muddy pools around Dak Bungalow. S. L. Hora. 28.x.1921. A single specimen.

*External Characters*:—Length 102 mm. Maximum diameter 3 mm. Segments 149. Colour grey, but with a faint pinkish tinge dorsally.

Prostomium prolobous.

Dorsal pores absent, but vestiges are visible in the middle of the body.

Nephridiopores in the line of the lateral setae.

The setae are closely paired;  $aa=4/5$   $bc$ ;  $dd=4/7$  of the circumference. The setae begin on segment ii.

The clitellum embraces segments x-xiii, but xiv and perhaps ix are slightly altered.

<sup>1</sup> On the fusion of the genera *Notoscolex* and *Megascolex* by Michaelsen cf. Michaelsen (6) and Stephenson (11).

The male pores are situated on small somewhat irregular transversely elongated papillae at the hinder border of segm. x; they are immediately outside—almost in—the line of setae *b*. Immediately behind the papillae of the male pores, on the anterior part of segm. xi, are a pair of smaller and rounder papillae. The midventral region between the four papillae is somewhat sunken, and darker in colour.

The female pores are minute, in furrow 11/12, in line with setae *ab*.

The spermathecal pores are conspicuous, with swollen margins, in furrow 7/8, between the lines of setae *ab* and *cd*, but nearer the latter. The upper end of the pore reaches the line *cd*.

*Internal Anatomy*:—Septa 5/6–8/9 are much thickened.

There are four gizzards, in segm. xiii–xvi, all well developed.

The last heart is in segm. ix.

The testis sacs are large, elongated in shape, and extend into segm. ix, though their greater part is in x; they reach as far back as septum 10/11, and are slightly constricted at septum 9/10. The vas deferens lies on the posterior face of septum 9/10; it is narrow, and thrown into numerous coils.

The prostates are elongated, cylindrical, and bent on themselves; the ental end is rather thicker, and there is no separate duct; the surface is soft and “glandular.” The vas deferens enters near the ental end.

Segm. xi is narrow antero-posteriorly, but there is no ovarian chamber; segm. xi is fully opened up on opening the body in the usual way. The segment was full of genital products and the female organs were not separately distinguishable. The ovisacs are large, stoutly and irregularly ovoid in shape, and extend back to septum 13/14.

The spermathecal ampulla is spherical; the duct forms coils on the posterior face of the septum. The atrium is large—not very much smaller than the ampulla; it is a pear-shaped sac, the lower and narrower portion marked by a number of slight annular constrictions, and prolonged into a narrow, bent, duct-like tube, joined at its termination by the spermathecal duct.

*Remarks*:—The relations of this species seem to be to *D. nepalensis* and *papillifer*.

Family MEGASCOLECIDAE.

Subfamily MEGASCOLECINAE.

Genus *Megascolex* Templeton.

*Megascolex konkanensis* Fedarb.

Bombay. Coll. Prof. J. P. Mullan.

The actual male pores are not usually visible; in these specimens they appear to be on the transverse ridge which runs across the male area on each side, nearer the outer than the inner margin of the area.

**Megascolex mauritii** (Kinb.).

Bombay. Coll. Prof. J. P. Mullan.

Ahmedabad. Coll. Prof. J. J. Asana.

**Megascolex horai**, sp. nov.

Cherrapunji, Assam; under stones and in muddy pools around Dak Bungalow. 28.x.1921. S. L. Hora. A single specimen.

*External Characters*:—Length 110 mm. Diameter 2.5 mm. Segments 188. Colour yellowish grey, no difference between dorsal and ventral surfaces. A long thin worm.

Prostomium slightly epilobous (?).

Dorsal pores begin in furrow 10/11.

The setae are disposed in rings; they are of fair size, and form fairly regular longitudinal lines. In front of the male pores the ventral break is equal to 3-4 *ab*; in the middle and hinder parts of the body to 2½-3 *ab*. The dorsal break is equal to 2-3 *yz* anteriorly, but is much smaller behind the genital region (1¼-1½ *yz*). The following numbers were counted: v/26, ix/27, xii/32, xix/32, and in the middle of the body 28.

The specimen was apparently not fully mature. There was no clitellum, and no genital papillae or markings of any kind.

The male pores are on segm. xvii, on papillae, in line with setae *b*, about one-fifth of the circumference apart.

The female apertures are not visible.

The spermathecal pores are in furrows 6/7 and 7/8, in or just internal to the line of *b*, about one-fifth of the circumference apart.

*Internal Anatomy*:—Septum 4/5 is thin, 5/6 is very thin, 6/7 is thin and attached to the ventral body-wall behind the normal site of insertion,—on the left side nearly at the level of furrow 7/8; the following septa as far as 13/14 are perhaps slightly strengthened, but not much; 7/8 is displaced backwards in the same way as 6/7, 8/9 is attached slightly behind its normal line of insertion, but the rest are not displaced. All the septa as far back as 12/13 are strongly convex backwards.

The gizzard is in segm. vi, firm and barrel-shaped.

Calcareous glands are present in segms. x, xi and xii; they are of moderate size, are stalked, and the margins may be lobulated. The intestine begins in xv.

The last heart appears to be in segm. xii.

There are tufted nephridia in segm. v. In the body generally the micronephridia are arranged in a single transverse row in each segment.

Testes and funnels are present in segms. ix and x. Seminal vesicles are found in xi only; they were small in size in the present specimen.

The prostates are small—perhaps not fully developed; they are lobular and deeply bifid on the outer border. The duct is bent round sharply at its ectal end.

Ovaries and perhaps funnels were seen in segm. xii.

The spermathecae are small sacs sessile on the body-wall, without duct. There is a single diverticulum, narrow and tubular, as long as or not quite so long as the ampulla; it arises from the inner side of the sac where it joins the body-wall.

There are no penial setae.

Genus *Pheretima* Kirb. em. Mich.

*Pheretima elongata* (E. Perr.).

Bombay. Coll. Prof. J. P. Mullan.

*Pheretima hawayana* (Rosa).

Dehra Dun; compound of the Forest Research Institute (serial no. 111 of 27.viii.1921).

*Pheretima heterochaeta* (Mich.).

Sariya Tal, about three miles from Naini Tal to the west, and at a lower level than Naini Tal; from underneath stone on the banks of the lake. A single specimen. Dr. B. Prashad.

Cherrapunji, Assam; under stones and in muddy pools around Dak Bungalow. 28.x.1921. S. L. Hora. Several specimens.

Two of the latter batch of specimens showed certain abnormalities, which led to my examining them more closely.

In one specimen, the number of segments counted on the dorsal surface was one greater than those seen ventrally; this was due to the presence of a spiral groove in the anterior part of the body. There were other spiral abnormalities further back, behind the genital region. The clitellum was incomplete on the right side from above the lateral line of the body to the midventral line; it embraced segments xiv-xvi. The male pore was on xviii on the left side, and on xx on the right. There was a papilla midventrally situated on xvii. Internally, and reckoning by the segments seen on the dorsal surface (the above appearances are described as seen from the ventral surface), the spermathecae are situated between segms. 6/7, 7/8, 8/9 and 9/10; that in 7/8 on the right side has a double ampulla with a single duct and diverticulum; the last heart is in segm. xiv. Seminal vesicles are present in xii, xiii and xiv on the right side, and in xii and xiii on the left. Ovaries and their funnels are present in xiv on the left, and in xiv, xv, xvi and xvii on the right. The prostate of the right side is absent; the male duct ends in xxi.

In the other specimen there were two male pores on the right side, on segms. xviii and xix, each smaller than normal. Internally, the prostate was small on the left side, and there was none on the right. On the right side, both vasa deferentia were continued into the anterior prostatic duct; there was a second prostatic duct in xix, but unconnected with the vasa deferentia. The right anterior prostatic duct was slightly stouter than the one behind it.

***Pheretima houletti* (E. Perrier).**

Bombay. Coll. Prof. J. P. Mullan.  
Dehra Dun; compound of Forest Research Institute (serial No. 111 of 27.viii.1921).  
Cherrapunji, Assam; under stones and in muddy pools around Dak Bungalow. 28.x.1921. S. L. Hora. Two specimens.

***Pheretima posthuma* (I. Vaill.).**

Dehra Dun; compound of Forest Research Institute (serial No. 111 of 27.viii.1921).

***Pheretima suctoria* Mich.**

Bombay. Coll. Prof. J. P. Mullan.

As the species has been met with only once previously, and as the present specimen shows a few variations from the description given by Michaelsen (3), I add the following notes:—

Length 205 mm. Diameter 6 mm. Colour a dark brown dorsally, paler ventrally. Prostomium small, epilobous 4/5; the grooves at the sides of the prostomium are hardly different from the numerous other longitudinal grooves round the mouth on the first segment; the backwardly extending process (tongue) of the prostomium not cut off by a groove behind. Dorsal pores from 13/14; perhaps a rudimentary pore in 12/13,—a deepening of the intersegmental groove in the middorsal line.

The setae are larger on the anterior segments (ij-vi).

The characteristic male area may be described as follows:—On segment xviii, taking up the whole length of the segment, are a pair of raised circular disc-like areas with well defined margins; the interval between these discs is less than the diameter of one of them, and shows seven setae intervening. There are also one or two setae on the inner and outer edges of the discs,—i.e. the setal ring is continued a little way into the discs at each side. The male pore is situated at the centre of the disc on a tiny papilla; and a faint ridge runs transversely across each disc in the line of the setae and of the male pore; behind the ridge, and also transverse in direction, is a slight depression. The discs are light in colour.

Michaelsen places the male pores at the outer border of the discs, about one-third of the circumference apart. This did not seem to be the case here; and from internal examination also the male apertures cannot be so far apart as that,—scarcely, I think, as much as one-fourth of the circumference apart.

The female pore appeared to be single, in a small depression.

Septum 4/5 was slightly thickened; 5/6, 6/7 and 7/8 were very stout; 10/11 was moderately thick, 11/12 and 12/13 decreasingly so.

The testis sacs were large, and came up laterally round the alimentary canal on each side, leaving the dorsal surface of the gut uncovered. In segm. xi the sacs enclose the hearts and cover in the seminal vesicles also; in x they enclose the hearts (though



at first sight this appears not to be the case; but the large dark vessel running superficial to the sac is not the proper heart).

The prostatic duct is looped or coiled; it is thin at first, but becomes stout towards its ectal end.

I found no ovisacs.

The spermathecae differ from those of Michaelsen's specimens (fig. 1). The ampulla is ovoid; the duct, nearly as long as the ampulla, is narrow at first, then swells and becomes shining and firm. The diverticulum is as long as the ampulla and duct together; it arises from the ectal end of the duct, and is narrow and tubular; its inner (ental) portion consists of a number of short closely adpressed loops and has a crenulated appearance; the ectal portion becomes smooth and shining towards its termination.



FIG. 1.—*Pheretima suctoriosa*; spermatheca.

### Genus *Perionyx* E. Perr.

#### *Perionyx excavatus* E. Perr.

Mashobra, Simla Hill States. 13.vi.1921. S. L. Hora. Two specimens and a few fragments.

Below Kufri, Simla Hill States; near stream, under stones and in moss. 28.ix.1921. Dr. S. W. Kemp. Four specimens, two quite immature.

#### *Perionyx modestus*, sp. nov.

Cherrapunji, Assam; under stones and in muddy pools, around Dak Bungalow. 28.ix.1921. S. L. Hora. A number of specimens.

*External Characters*:—A long specimen measures 167 mm., but sexual specimens are found down to 85 mm. Diameter, max. 4 mm. Segments 174. Colour deep purple dorsally; lighter, of a violet tint, ventrally. The body is somewhat flattened dorso-ventrally.

Prostomium epilobous  $\frac{1}{2}$ ; tongue not closed behind.

Dorsal pores begin from furrow 4/5.

The setae are in rings, and are more closely set ventrally. The dorsal break is either absent or very small ( $zz = \text{ca. } 1\frac{1}{4} yz$ ); the ventral break is absent or very small behind the genital region, and small ( $\text{ca. } 1\frac{1}{4} ab$ ) in front of the genital region. The following numbers were counted: v/ ca. 38, ix/41, xii/40, xix/42, and 42 in the middle of the body.

There was no clitellum to be seen in any of the specimens.

The male pores are on segm. xviii, the anterior and posterior borders of which are bowed forwards and backwards respectively. The segment presents a transverse groove, usually shallow but occasionally deep. The pores are short longitudinally placed slits at the ends of the groove; they are not far from the midventral line, in line with about the fourth seta on each side.

The female pores were not visible.

The spermathecal apertures are in furrows 7/8 and 8/9, near together, about in line with the third seta on each side.

There are no other genital marks.

*Internal Anatomy*:—Septa 6/7 and 7/8 are slightly thickened, 8/9 and 9/10 moderately so.

The gizzard is vestigial, in segment v. There are no calciferous glands; but the oesophagus is dark in colour, with transverse vascular striations, in segms. xii and xiii. The intestine begins to widen out behind the prostates.

The last heart is in segm. xiii.

The nephridia all end in the same line.

Testes and funnels are free in segms. x and xi. Seminal vesicles are present in segms. xi and xii; they fill the length of their segments, and are apposed to their fellows in the middorsal line.

Prostates are present in segm. xviii, but are very small; the duct is stout in relation to the size of the gland, is muscular and shining, and almost straight.

Ovaries and funnels are present in segm. xiii.

The spermathecae, in segms. viii and ix, are small elongated sacs, with no distinguishable duct, and a minute wartlike diverticulum near their base (not present in all).

There are no penial setae.

#### Subfamily *OCTOCHAETINAE*.

##### Genus *Octochaetus* Bedd.

##### *Octochaetus beatrix* Bedd.

Bombay. Coll. Prof. J. P. Mullan.

The original description of this species was given by Beddard (2) in 1902. In 1914 I described as a new species a worm which I called *Octochaetus dasi* (8), but I now believe that this is identical with Beddard's species. The following notes fill in a few gaps in our knowledge.

Prostomium epilobous  $\frac{1}{2}$ ; the tongue is very narrow, and not cut off behind.

The setae in the present specimen were spaced as follows:—in the middle of the body, and behind the genital region  $ab=1/3$   $aa=2/5$   $bc=2/3$   $cd$ ; on segm. ix  $ab=\frac{1}{2}$   $aa=\frac{1}{2}$   $bc=2/3$   $cd$ ;  $dd=2/3$  of the circumference.

The male area is a somewhat quadrilateral depression with rounded angles, small, rather deep, midventrally on segms. xvii-xix; it indents the posterior border of the clitellum, and is comprised within the lines of setae *a*. Small papillae are seen in the line of *b*, on the borders of the depression, in segms. xviii and xix, perhaps the porophores of the male and posterior prostatic apertures respectively; there is not distinct papilia or aperture on xvii. No seminal grooves were visible.

The female pore or pores are indicated by a small midventral depression on the anterior part of segm. xiv.

The spermathecal pores are two pairs, on minute papillae close to the middle line, the least trifle in front of the setal zones of segms. viii and ix.

Septum 5/6 is somewhat strengthened; the next is 8/9, slightly thickened; 9/10, 10/11, and 11/12 are somewhat strengthened, 12/13 very slightly so, and the rest are thin.

Previous statements regarding the absence of penial setae appear to be mistaken. There was very little to indicate their presence; but an endeavour to isolate and mount the sac was successful in revealing one. This was very small, .6 mm. long, and  $13\mu$  thick at its middle; the shaft has a slight double curve, and the tip is fairly sharply pointed; the ornamentation consists of a few irregular indentations of the margin near the free end (fig. 2). No copulatory setae from the spermathecal segments could be obtained.



FIG. 2.—*Octochaetus beatrix*; penial seta:  $\times 460$ .

#### Genus *Erythraeodrilus* Steph.

##### *Erythraeodrilus kempfi* var. *bifoveatus* (Steph.).

Bombay. Coll. Prof. J. P. Mullan.

I accept Michaelsen's recent separation of this and allied species from the genus *Hoplochaetella*, and their union with *Erythraeodrilus* (7). It now seems to me that the difference between the two species that I formerly described separately as *kempfi* and *bifoveata* (10) is scarcely sufficiently marked to justify their being kept apart.

#### Genus *Eutyphoeus* Mich.

##### *Eutyphoeus orientalis* (Bedd.).

Dehra Dun; compound of Forest Research Institute (serial No. 111 of 27.viii.1921).

This species, obtained from near Calcutta by Beddard and from Dehra Dun by Fedarb, has not been seen since 1898. It is interesting to find it now in a batch of worms from Dehra Dun, one of the previously recorded localities. The following details may be noted:—

On segm. xvii are a pair of grooves or cracks, shaped like square brackets — [ ] — overhung on their outer side by a thickened ridge; the male pores, with penial setae projecting, are in the posterior corners of the brackets. The longitudinal part of the grooves, and the pores themselves, are a little outside the line of setae *b*.

The spermathecal apertures are transverse slits with their centre between *b* and *c*, but nearer *c*,—the outer end of the slit reaches the line of *c*.

The spermathecae are somewhat ovoid sacs; the duct is very short and stout, from the under surface of the ampulla; the margin of the ampulla is crenated. The diverticula are two, attached to the beginning of the duct and rather on its posterior side; they appear to have one, two, or three small chambers.



FIG. 3.—*Eutyphoeus orientalis*; penial setae:  $\times 300$ .

The peculiar penial setae are  $2\frac{1}{2}$  mm. long. and  $26\mu$  thick in the middle; the shaft is almost straight, and the tip is bluntly pointed. The oblique markings, closely set along the borders of the distal end of the seta, are interpreted by Beddard as "chevron-shaped ridges"; but the appearance is almost as if there were a cleavage along the oblique lines (fig. 3).

### *Eutyphoeus waltoni* Mich.

Dehra Dun; compound of Forest Research Institute (serial No. III of 27<sup>vii</sup>1921).

### Genus *Eudichogaster* Mich.

#### *Eudichogaster mullani*, sp. nov.

Bombay. Coll. Prof. J. P. Mullan.

*External Characters*:—Length 134 mm. Diameter 6 mm. Segments 200. Colour a light and even grey, no difference between dorsal and ventral surfaces. Anterior end rather bulbous. Secondary annulation on the anterior segments; iv and v biannular, vi triannular, vii and onwards to the clitellum with four, five or even more annuli.

Prostomium small and prolobous; a median dorsal groove divides segm. i throughout its length.

Dorsal pores very small, the first in furrow 12/13; perhaps a small or rudimentary pore in 11/12.

Setae are not visible in segments ii–iv, and only a few are seen in v and vi. In the middle of the body  $ab=2/7$   $aa=2/5$   $bc=2/3$   $cd$ , and  $dd=ca. 4/7$  of the circumference; behind the genital region  $ab=1/4$   $aa=1/3$   $bc=4/7$   $cd$ , while  $dd=2/3$  of the circumference; in the anterior segments the ratios are about the same as these last.

The clitellum is not distinctly developed, but perhaps extends over  $\frac{1}{2}$ xiii– $\frac{1}{2}$ xvii.

The midventral region of segments xvii–xix is depressed, the depression extending laterally from the line of setae *b* on one side to an equivalent extent on the other; in the bottom of the depression is an irregular slightly raised rough patch. The prostatic pores are perhaps on four small papillae at the angles of the depression, in or very slightly outside the line of setae *b*, and very slightly anterior to the setal zone of xvii and very slightly posterior to that of xix respectively.

On the anterior border and behind the posterior border of the rough patch in the depressed area, in other words posteriorly on segments xvii and xix respectively, and in the midventral line, are two papillae of small size, each appearing to have a pore in its centre.

The female pores were not seen.

On segment viii is a roughened patch, slightly elevated and extended in a transverse direction on each side to a little beyond the line of seta *d*; it is narrow antero-posteriorly, and does not embrace the anterior two-fifths of the segment, nor, except between the lines of setae *b* and *c*, the posterior fifth either. Both pairs of setae are thus included in the patch. The spermathecal apertures are not visible, but from internal examination they are two pairs, behind furrows 7/8 and 8/9, but slightly in front of the setal zones of segments viii and ix, between the lines of setae *b* and *c*, but nearer to that of *b*.

*Internal Anatomy:*—Septum 4/5 is thin, 5/6 and all succeeding septa as far as 10/11 are moderately strong, 8/9 and 9/10 being the thickest of the series; 11/12 is somewhat thickened, and the rest are thin.

The gizzard in segment v is large, spherical, and very firm; that in vi is rather smaller. Calciferous glands are present in segments xi and xii; they are dark in colour, ovoid or kidney-shaped, well set off from the gut, not stalked but attached by one edge. The intestine begins in segm. xv.

The last heart is in segm. xii.

Behind the genital region the micronephridia are arranged in a transverse row in each segment, about nine on each side; there is no marked difference in size, the most internal being a little smaller than the rest and a little closer together. At the hinder end of the body the arrangement is much the same; there are about seven nephridia on each side, and the innermost of the series is scarcely larger than the rest—a little larger than the one next to it.

Testes and funnels are free in segms. x and xi. Seminal vesicles are present in segms. ix, x and xii; in xii they are small, in ix smaller still, and in x there was one only, on the right side, and this was quite minute.

The prostates, in segms. xvii and xix, are small; the glandular part is disposed in a few loose coils or loops; the duct is thin, of the same diameter as the glandular part, but muscular and shining.

The spermathecae are in segments viii and ix; the ampulla is small and ovoid; the duct is short, and relatively wide. The diverticulum is a small wart-like swelling on the side of the duct.

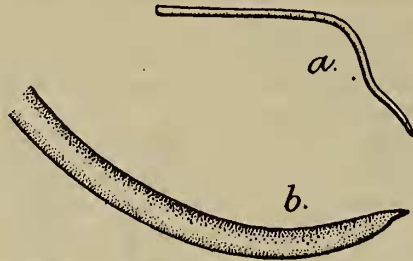


FIG. 4.—*Eudichogaster mullani*; copulatory seta; a, whole seta:  $\times 50$ ; b, tip of seta:  $\times 300$ .

Copulatory setae are found on segm. viii, in the site of the ventral bundles. In length, measured across the bend, they are 7 mm. or more, and their thickness at the middle is  $16\mu$ . The distal half is either curved through a quarter of a

circle, or bent and twisted more irregularly. The tip ends in a blunt point; there is no ornamentation (fig. 4).

#### Family LUMBRICIDAE.

##### Subfamily GLOSSOSCOLECINAE.

##### Genus *Pontoscolex* Schmarda.

##### *Pontoscolex corethrurus* (Fr. Müll.).

Ahmedabad. Coll. J. J. Asana. Several specimens.

##### Subfamily LUMBRICINAE.

##### Genus *Helodrilus* Hoffm.

##### *Helodrilus* (*Allolobophora*) *caliginosus* subsp. *trapezoides* (Ant. Dug.).

Sariya Tal, about three miles to the west of Naini Tal, and at a lower level than Naini Tal; from underneath stone on the banks of the lake.

Dr. B. Prashad. Two specimens, one mature, one immature.

Sukla Tal, almost a mile to the west of Naini Tal; 7000 ft.; from the margins of the lake. Dr. B. Prashad. Several specimens.

Gandarbal, Kashmir; ponds in the course of a shallow irrigation streamlet. Ca. 6000 ft. 14.vi.1921. Dr. B. Prashad. Two specimens.

Anchar Lake, Kashmir (an extensive marshy and weedy area in the course of the Sind River). 29.vi.1921. Dr. B. Prashad. A number of specimens.

##### *Helodrilus* (*Allolobophora*) *prashadi*, sp. nov.

Gandarbal, Kashmir; ponds in the course of a shallow irrigation streamlet. Ca. 6000 ft. 14.vi.1921. Dr. B. Prashad. Several specimens.

*External Characters*:—Length 62 mm. Diameter 3 mm. Segments 133. Colour grey, with a slightly pinkish tinge.

Prostomium proepilobous.

Dorsal pores begin in furrow 4/5 or 5/6.

The setae are closely paired; *aa* is nearly twice *bc*; *ab* is greater than *cd*; *dd* is less than half the circumference.

The clitellum extends from part of segment xxiii or segment xxiv to xxxii or xxxiii (= 9 to more than 10). The clitellum is saddle-shaped, and the clitellar region is swollen, and flattened ventrally. "Ridges" or "walls" are present on segms. xxix-xxxi; and the ventral setae in these segments are implanted on minute papillae.

The male pores are seated on very prominent papillae, hemispherical in shape on xv and encroaching also on xiv and xvi; the centres of the papillae are just outside the line of setae *b*.

Female pores were not visible. Spermathecal pores are absent.

The ventral setae of segment xii, and sometimes those of segments xi and x, are situated on papillae.

*Internal Anatomy*:—Septum 5/6 is thin, 6/7, 7/8 and 8/9 are much thickened, 9/10 is fairly thick, and succeeding septa as far as 13/14 gradually diminish in thickness; the rest are thin.

The gizzard comprises two segments, xvii and xviii.

Testes and funnels are free in segms. x and xi. Seminal vesicles are present in ix, x, xi and xii; those in x are the smallest, though they are not much smaller than those in ix; those in xi and xii have a nodular surface, indeed they are almost racemose, being composed of small spherical lobules.

Spermathecae are absent.

The lateral setae of segments xi and xii are seen on internal dissection to be contained in large sacs. On examination they are found to be 76 mm. long, and almost straight; they are fairly sharply pointed, and the distal portion is grooved as in the clitellar setae of *Lumbricus terrestris*.

*Remarks*:—This species disagrees with the great majority of the subgenus, and resembles *Bimastus*, in having no spermathecae. This peculiarity has been recorded by Michaelsen in the case of *H. (A.) agatschiensis* (4).

### ***Helodrilus (Dendrobaena) kempii*, sp. nov.**

Kufri, Simla Hill States; 7800 ft. Oct. 1921. Dr. S. W. Kemp. Two specimens, one mature.

*External Characters*:—Length 91 mm. Diameter 6 mm. Segments 128. Nonpigmented, light grey in colour.

Prostomium epilobous  $\frac{1}{2}$ , the tongue not cut off behind.

Dorsal pores from furrow 9/10.

The setae are small; anteriorly  $ab = \frac{1}{3}$   $aa = \frac{1}{2}bc = cd$ ; behind the male apertures the intervals between the individuals of a pair begin to widen, and behind the clitellum this separation becomes greater still, so that in the middle of the body the setae are no longer paired. Here  $ab = \frac{1}{2}-\frac{3}{5}$   $aa = 1\frac{1}{4}-1\frac{1}{2}$   $bc = 2$   $cd$  or nearly;  $dd = 1\frac{1}{3}-\frac{2}{5}$  of circumference.

The nephridiopores are just above the line of setae *b*.

The clitellum is saddle-shaped, and extends over segms. xxix-xxxiv (= 6). The ridges of puberty are indistinct, and appear to be coextensive with the clitellum, or perhaps exclude the last segment and half of the first.

The male pores are on segm. xv; they appear as transverse slits which extend from the line of setae *b* to that of *c*, with tumid anterior and posterior lips which cause the limits of segment xv to bulge forwards and backwards.

The spermathecal apertures are in furrows 9/10 and 10/11, in the line of setae *d*.

*Internal Anatomy*:—Septum 4/5 is thin, 5/6 - 15/16 are thickened, 6/7-8/9 most so, the rest only slightly.

The gizzard takes up two segments; xvii and xviii. There are oesophageal pouches in segm. x; the calciferous glands in xi form large lateral widenings of the oesophagus which, however, are not set off from the tube; they are continued back, but are less prominent, in xii, and are not distinguishable behind this.

The last heart is in xii, but this is much smaller than the one in xi, and is at a deeper level.

Testes and funnels are free, in segms. x and xi. There are four pairs of seminal vesicles, in segms. ix-xii, all of quite moderate size; those of segm. x are equal in size to those of ix.

Spermathecae are present in segms. x and xi as small round sacs sessile on the body-wall.

The ventral setae of segm. xv are slightly modified. The points are apparently softened; the characteristic feature is a faint sculpturing of the distal portion of the shaft by a numerous series of transverse markings, slightly jagged and convex towards the insertion of the seta (fig. 5).



FIG. 5.—*Helodrilus* (*Dendrobaena*) *kempfi*; genital seta from segm. xv:  $\times$  ca. 200.

#### *Helodrilus* (*Bimastus*) *constrictus* (Rosa).

Mashobra, Simla Hill States. 13.vi.1921. S. L. Hora. A single specimen, incomplete behind.

#### *Helodrilus* (*Bimastus*) *parvus* (Eisen).

Sukha Tal, almost a mile to the west of Naini Tal; ca. 7000 ft. From the margins of the lake. Dr. B. Prashad. Five specimens. Chenar Bagh Nullah (a very shallow slow-running stream with a sandy, and muddy bottom), Srinagar, Kashmir. 6-8.vi.1921. Dr. B. Prashad. A single specimen.



Genus *Octolasion* Örley em. Rosa.

*Octolasion lacteum* (Örley).

Mashobra, Simla Hill States. 13.vi.1921. S. L. Hora. Two specimens, immature, probably belonging to the above species.

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